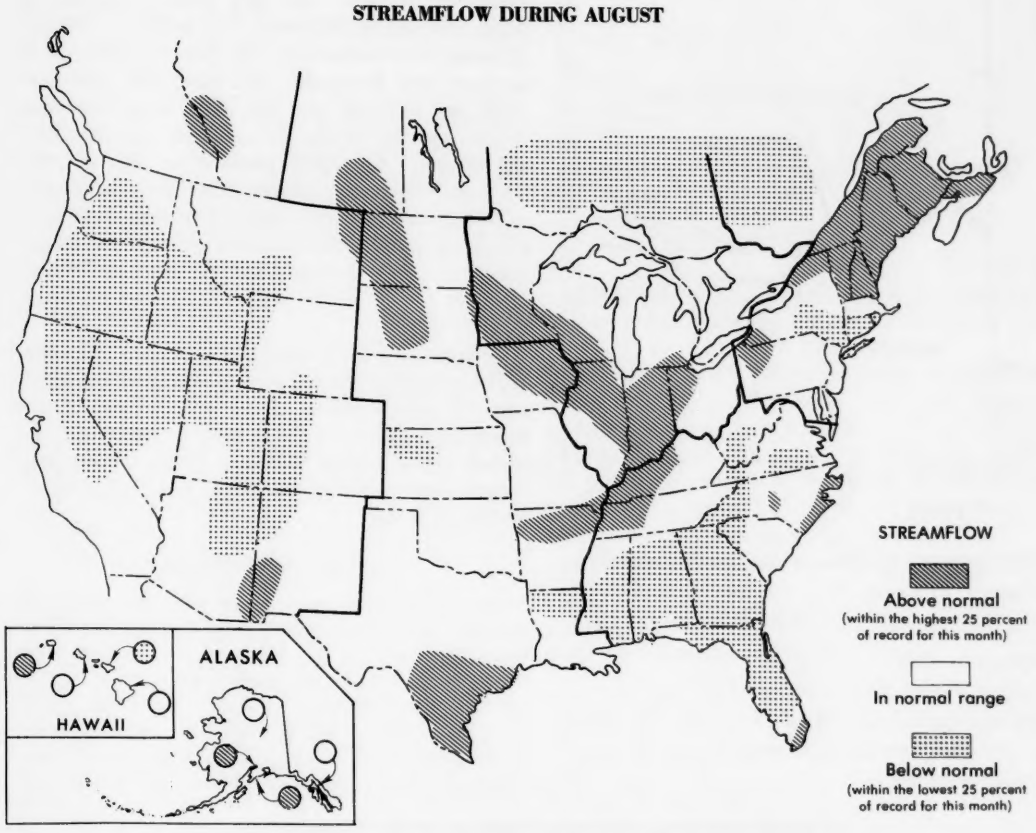
WATER RESOURCES REVIEW for AUGUST 1981

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW DURING AUGUST



STREAMFLOW AND GROUND-WATER CONDITIONS

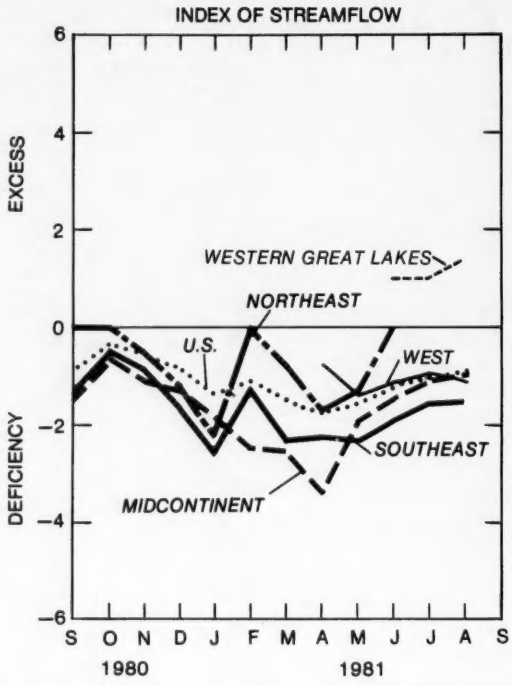
Streamflow decreased seasonally throughout most of the West and Western Great Lakes Regions and also in Iowa, Kentucky, Louisiana, Missouri, Texas, West Virginia, and coastal States in the Northeast Region extending from Maryland to Massachusetts. Monthly mean flows generally increased in Hawaii, Maine, New Hampshire, Oklahoma, South Carolina, and Vermont, and were variable elsewhere.

Below-normal streamflow persisted in two large areas, one in and adjacent to Georgia in the Southeast Region and the other in and adjacent to Nevada in the West Region. Monthly mean flows were lowest of record for August in parts of Florida, Georgia, Kansas, and Quebec. Water-use restrictions were in effect in parts of Connecticut and North Carolina.

In contrast to the areas of below-normal streamflow, mean flows in northern New England were generally above the normal range, as were flows in much of the Western Great Lakes Region and parts of the Dakotas. Near-record local flooding occurred in southern Texas, the southern tip of Florida and coastal areas of North Carolina. Flooding also occurred in Colorado, Indiana, Maine, Nebraska, Nevada, New Mexico, and Ohio. Monthly and/or daily mean flows were highest of record for the month in parts of New Brunswick, New Hampshire, New York, North Dakota, and Maine.

Ground-water levels continued to decline seasonally in the central and southern parts of the Northeast Region, but levels generally rose in Maine. Levels near the end of the month were above average in most of Maine, and remained below average in Rhode Island, southeastern Massachusetts, northern New Jersey, and most of Maryland and Delaware. In the Southeast Region, levels declined in Kentucky, Virginia, Mississippi, and Alabama; trends were mixed in other States. Levels were above average in Kentucky, below average in Virginia, and above and below average in West Virginia and North Carolina. In the Western Great Lakes Region, levels rose in Minnesota and Illinois, declined in Michigan and Ohio, but held steady in Indiana. Levels were above average in Illinois and Indiana, about average in Ohio, near or below average in Michigan, and above and below average in Minnesota. In the Midcontinent Region, levels rose and were above average in Nebraska, and declined and were below average in Arkansas. Trends were mixed in North Dakota and in Iowa, but levels were below and above average, respectively, in these States. Trends were mixed and were above and below average in other States in the region. In the West, levels declined in Washington, Idaho, and Utah; trends were mixed elsewhere in the region. Levels were below average in Washington and in Arizona, and mixed with respect to average in other States.

A new high ground-water level for August occurred in Nevada. New August lows were recorded in Arkansas, Idaho, New Mexico, North Dakota, Tennessee, Texas, and Virginia. New alltime low levels occurred in Arizona, Idaho, Kansas, and Utah.



The index of streamflow is computed by multiplying the percent of a region that is deficient or excessive by the average duration of deficiency or excess. During August, the index of streamflow deficiency for the Southeast Region changed slightly to a value of −1.57 when 56 percent (i.e., 0.56) of the area in the Southeast was deficient for an average duration of 2.8 months (0.56 X 2.8 = 1.56).

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States.]

Streamflow decreased seasonally in Connecticut, Delaware, Maryland, and New Jersey, increased in Maine, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of New Brunswick, New Hampshire, and New York, and increased into that range in parts of Nova Scotia, Quebec, Maine, Pennsylvania, and Vermont. Below-normal streamflow persisted in parts of New York and Quebec, and decreased into that range in parts of Connecticut. Monthly and/or daily mean flows were highest of record for the month in parts of New Brunswick, Maine, New Hampshire, and New York, and lowest of record for the month in parts of Quebec. Flooding occurred in Maine.

Ground-water levels continued to decline seasonally in the central and southern parts of the region, but levels generally rose in Maine. Levels near the end of the month were above average in most of Maine, and remained below average in Rhode Island, southeastern Massachusetts, northern New Jersey, and most of Maryland and Delaware.

STREAMFLOW CONDITIONS

In northern Maine, rapid runoff from two periods of extremely heavy rain caused local flooding and mudslides, especially in the Caribou area, with damage estimated in the 3- to 4-million-dollar range. The monthly mean discharge of 23,230 cfs in St. John River below Fish River, at Fort Kent (drainage area, 5,690 square miles), was highest for August in 55 years of record and was more than 6½ times the median flow

CONTENTS

for the month. In the central part of the State, monthly mean discharge of Piscataquis River near Dover-Foxcroft increased, contrary to the normal seasonal pattern of decreasing flow, to twice the median flow for August, and was in the above-normal range. In southern Maine, the monthly mean flow of 130 cfs in Little Androscoggin River near South Paris (76.2 square miles) was highest for August in 60 years of record, and was over 7 times the median discharge for that site.

In central New Hampshire, where monthly mean discharge in Pemigewasset River at Plymouth (drainage area, 622 square miles) was above the normal range in July, flow increased sharply and the monthly mean discharge of 1,570 cfs and the daily mean discharge of 9,660 cfs on the 16th were highest for August in 78 years of record.

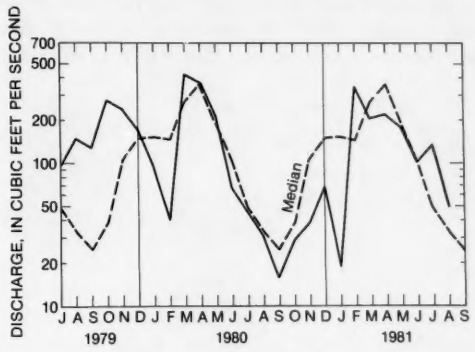
Similarly, in southern New Brunswick, the monthly mean discharge of 463 cfs in Lepreau River at Lepreau (drainage area, 92.1 square miles) was highest for August since records began in 1916, and was over 8 times the median discharge for that site. In the northern part of the Province, monthly mean flow of Upsalquitch River at Upsalquitch decreased seasonally but remained in the above-normal range for the 2d consecutive month.

In central Nova Scotia, monthly mean discharge of St. Marys River at Stillwater increased seasonally and was above the normal range for the first time since February. Elsewhere in the Province, mean flows at index stations decreased seasonally, remained above median, and were within the normal range.

South of the St. Lawrence River in eastern Quebec, monthly mean flow of Matane River near Matane increased, contrary to the normal seasonal pattern, and was above the normal range for the first time since April. In southern Quebec, mean flow of St. Francois River at Hemmings Falls increased sharply to 5½ times median and was above the normal range. Also in southern Quebec, but north of the St. Lawrence River, the monthly mean discharge of 2,240 cfs in St. Maurice River at Grand Mere (drainage area, 16,300 square miles) was only 14 percent of median and lowest for August in 81 years of record. In southwestern Quebec, monthly mean discharge in Harricana River at Amos decreased to only 64 percent of median and was below the normal range for the first time since July 1980. Elsewhere in Quebec, mean flows at index stations were within the normal range and slightly below median.

In central Vermont, monthly mean discharge in Dog River at Northfield Falls increased sharply to 256 percent of median and was above the normal range.

In central Massachusetts, where monthly mean discharge of Ware River at Intake Works, near Barre was above the normal range and almost 3 times median in July, mean flow decreased seasonally to 1½ times median in August and was within the normal range. (See graph.)



Monthly mean discharge of Ware River at Intake Works near Barre, Mass (Drainage area, 96.8 sq mi; 250.7 sq km)

In Connecticut, streamflow decreased seasonally and was generally below the normal range. For example, monthly mean discharge in Pomperaug River at Southbury decreased sharply to only 36 percent of median and was below the normal range for the 10th time in the past 12 months. Water-use restrictions were initiated in the city of Danbury during the month.

In northern New York, the monthly mean discharge of 671 cfs and the daily mean flow of 1,731 cfs on the 17th in West Branch Oswegatchie River near Harrisville (drainage area, 258 square miles) were highest for the month in 66 years of record, and flow at that site remained in the above-normal range for the 3d consecutive month. In the south-central part of the State, monthly mean discharge in Susquehanna River at Conklin continued to decrease seasonally, was only 52 percent of median, and was below the normal range for the first time since April. On Long Island, mean flow of Massapequa Creek at Massapequa decreased seasonally, was only 33 percent of median, and remained in the below-normal range for the 12th consecutive month. Elsewhere in the State, monthly mean flows at index stations on the Mohawk and Hudson Rivers were slightly above median and within the normal range.

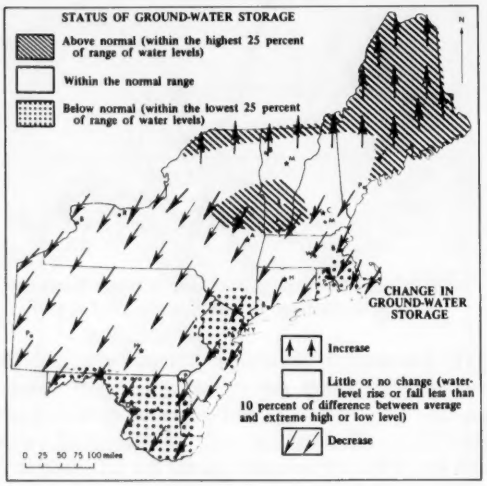
In northwestern Pennsylvania, monthly mean discharge in Oil Creek at Rouseville increased, contrary to the normal seasonal pattern, was 385 percent of median, and was above the normal range. Also in that part of the State, mean flow in Allegheny River at Natrona decreased seasonally and was above the normal range for the 2d time in the past 3 months. Elsewhere in the State, mean flows at index stations decreased, were near or slightly above median, and remained in the normal range.

In Delaware, Maryland, New Jersey, and Rhode Island, monthly mean flows at index stations generally

decreased seasonally, were less than median, and within the normal range.

GROUND-WATER CONDITIONS

Ground-water levels continued to decline seasonally in the central and southern parts of the region, changed only slightly in much of New Hampshire and Vermont, and rose in most of Maine. (See map.) Levels near the end of the month were above average in most of Maine and in parts of southern New Hampshire and Vermont. Levels remained below average in Rhode Island, southeastern Massachusetts, northern New Jersey, and most of Maryland and Delaware. Levels remained moderately below average on Long Island, N.Y. (within the lower mid-quartile).



Map shows ground-water storage near end of August and change in ground water storage from end of July to end of August.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow generally increased in Coastal and Piedmont regions from North Carolina to Alabama and decreased elsewhere in the region. Tropical storm Dennis brought as much as 20 inches of rain to the southwest of Miami and caused near record flooding on August 17–19. Dennis also soaked the eastern North Carolina coast with up to 10 inches of rain causing local flooding. Monthly mean flows remained below the normal range in Florida, Georgia, Alabama, and in the Blue Ridge part of North Carolina; they decreased into that range in parts of Mississippi, Virginia and West Virginia. Record-low flows were observed in parts of Florida and Georgia, and water-usage restrictions were imposed in several towns in western North Carolina. Monthly mean flow was above the normal range in western parts of Kentucky and Tennessee, in parts of the North Carolina Coastal Plain, and in the extreme southern part of Florida.

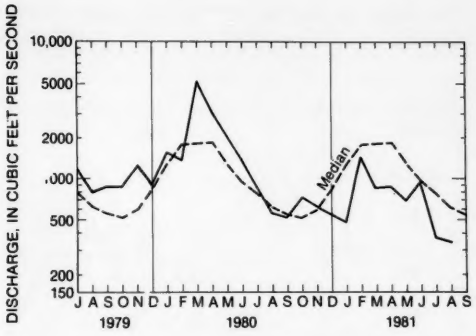
Ground-water levels declined in Kentucky, Virginia, Mississippi, and Alabama; trends were mixed in other States. Levels were above average in Kentucky, below average in Virginia, and above and below average in West Virginia and North Carolina. New August low levels were reached in Virginia and Tennessee.

STREAMFLOW CONDITIONS

In Alabama, streamflow was below the normal range in southeastern and western parts of the State and in the normal range elsewhere. Monthly mean flow in Conecuh River at Brantley increased from last month to 31 percent of median for August but remained below the normal range for the 6th consecutive month, while flow in Tombigbee River at Demopolis lock and dam, near Coatopa, decreased to 48 percent of median for the month and was below the normal range for the 2d consecutive month.

In Florida, streamflow increased nominally over the extreme low flows in July but remained mostly in the below-normal range. Although tropical storm Dennis brought as much as 20 inches of rainfall August 17 through 19 and caused nearly record-level flooding in some areas southwest of Miami, no appreciable amount of runoff was measured at the nearest index station on Fisheating Creek at Palmdale (drainage area, 311 square miles), where monthly mean flow was only 7.0 cfs—the lowest for August in 51 years of record. Nevertheless, precipitation from tropical storm Dennis was the first significant rainfall for over a year and replenished the nearly depleted water in the lower Everglades. The water level in Lake Okeechobee, which had dropped to a record-low of 9.77 feet, rose to 11.07 feet. In eastern Florida, St. Johns River near Christmas (drainage area, 1,539 square miles) also established a new monthly low of 11 cfs following an alltime low last month. On the other side of the Peninsula, monthly flow in Peace River at Arcadia increased considerably but remained below the normal range and was only 26 percent of median for the month. In north-central Florida, mean flow varied from 40 to 58 percent of median and remained below the normal range. By contrast, the mean flow of Shoal River near Crestview in northwestern Florida increased to 70 percent of median and was in the normal range following 5 consecutive months of flow in the below-normal range.

In Georgia, except for the northern part, where streamflow in the Etowah River at Canton (see graph)



Monthly mean discharge of Etowah River at Canton, Ga. (Drainage area, 605 sq mi; 1,570 sq km)

continued to decline, reaching another monthly low, streamflow increased over the monthly-low flows in July but remained in the below-normal range. Based on flows at index stations, monthly mean flows were 41 to 58 percent of median for the month in western Georgia, 17 percent of median in southern Georgia, and 51 percent of median in the southeastern part of the State.

In Kentucky, streamflow decreased seasonally but remained above the normal range in western Kentucky, while flow declined into the normal range in eastern Kentucky. Mean flow of Green River at Munfordville was 184 percent of median and above the normal range, while that of Licking River at Catawba was 77 percent of median and in the normal range.

In Mississippi, streamflow decreased into the below-normal range except for the southwestern corner of the State, where mean flow in the Amite River basin was within the normal range. Mean flow of Pascagoula River at Merrill in the southeastern part of the State was 51 percent of median, and that of Big Black River near Bovina in the west-central part of the State was 32 percent of median.

In North Carolina, streamflow ranged from the below-normal range in the mountains and in the western Piedmont to the above-normal range in part of the Coastal Plain. Because of drought conditions in the mountains, restrictions on water usage were imposed in Marion, Weaverville, Boone, and Canton. Tropical storm Dennis brought as much as 10 inches of rain to eastern areas such as Wilmington, Clinton, and Manteo, but there was no rainfall west of Greensboro. Monthly mean flows were only 47 percent of median in French Broad River at Asheville, and 57 percent of median in South Yadkin River near Mocksville. By contrast, monthly mean flow in Deep River at Moncure was 1.92 times the median for the month.

In South Carolina, streamflow increased to near median or above median and was in the normal range at all index stations.

In Tennessee, streamflow decreased but was in the normal range, except in the western part of the State, where the mean flow in Buffalo River near Lobelville increased slightly to 153 percent of median and was above the normal range. Monthly mean flow at other index stations ranged from 62 to 97 percent of median.

In Virginia, streamflow generally decreased and ranged from below the normal range in the southern and southwestern parts of the State to the normal range elsewhere. Flow in Slate River near Arvonia increased but remained in the normal range. Monthly mean flows were below the normal range in Nottoway River near Stony Creek and North Fork Holston River near Saltville and were 39 and 51 percent of median at the respective sites.

In West Virginia, streamflow decreased seasonally and mean flow in Kanawha River at Kanawha Falls decreased into the below-normal range at 67 percent of median for the month. Flows at other index stations, although in the normal range, were less than 70 percent of median for August.

GROUND-WATER CONDITIONS

In West Virginia, levels in key wells declined in most of the State during August except for a few counties along the Ohio River. Storage was above average in the northwestern one-third of the State and below average elsewhere.

In Kentucky, levels declined seasonally, but generally were above average in most parts of the State.

In Virginia, levels at the end of August showed continued declines of 0.4 to 0.8 foot below last month and 0.9 to 7.2 feet below long-term averages for these wells at this time of year. The level in the Tyler well in Louisa County reached a new record low for August—the sixth consecutive new month-end low at this site.

In western Tennessee, the level in the key artesian well in the "500-foot sand" aquifer near Memphis declined slightly, reaching a new August low in 40 years of record.

Levels in shallow water-table wells in North Carolina continued to decline in most of the mountain and Piedmont regions of the State and were generally 1 to 3 feet below normal. Levels in most Coastal Plain wells rose and were near or slightly above normal.

In Mississippi, levels in observation wells declined statewide. Levels in wells screened in the Cockfield Formation declined less than 1 foot while wells in the Sparta Sand declined from 1 to 3.5 feet around the Jackson

metropolitan area. Levels in the Citronelle, Graham Ferry, and Miocene aquifers in southern Mississippi continued to decline moderately with the exception of a few sites near heavy pumping where levels declined more than 3 feet. In northern Mississippi, levels in wells in the Wilcox and Upper Cretaceous aquifers declined moderately, but at a few sites in Lee County levels in wells in the Putaw and Tuscaloosa Formations showed significant declines near the influence of heavy pumping. In the Mississippi River alluvial aquifer, levels declined less than a foot.

In Alabama, water levels generally declined statewide and were 1 to 2 feet lower than those of August 1980.

In Georgia, water levels in wells in the Piedmont ranged from 0 to 0.4 foot lower than at the end of July and were as much as a foot lower than a year ago. In the coastal counties, levels in the principal artesian aquifer were from 0.2 to 2.5 feet higher than last month. The level in the water-table aquifer rose almost 7 feet during the month and was about 2 feet above median at month's end. In the southwest, water levels were from 0 to 3 feet higher than at the end of July and were from 0 to 10 feet lower than in August 1980.

In Florida, water levels in key wells rose slightly but continued below those of August 1980. Levels at month's end ranged from a rise of more than 4½ feet near Mulberry to a decline of a little more than a foot near Tallahassee. Near Mulberry the levels were slightly more than a foot above average.

WESTERN GREAT LAKES REGION

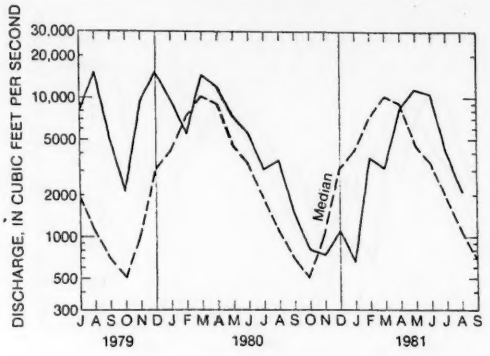
[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow decreased at all index stations in the region except in parts of Illinois, Michigan, and Minnesota, where flows increased contrary to the normal seasonal pattern. Monthly mean discharges remained in the below-normal range in parts of Ontario, and remained in the above-normal range in parts of Illinois, Indiana, and Ohio. Flooding occurred in Indiana and Ohio.

Ground-water levels rose in Minnesota and Illinois, declined in Michigan and Ohio, but held steady in Indiana. Levels were above average in Illinois and Indiana, about average in Ohio, near or below average in Michigan, and above and below average in Minnesota.

STREAMFLOW CONDITIONS

In the Lafayette-Crawfordsville area of west-central Indiana, rapid runoff from rainfall amounts reported to have exceeded 11 inches during the last week of the month, resulted in flooding along many streams. In the southern part of the State, runoff from rains early in August caused stream stages to rise but did not cause flooding. Monthly mean flows of Wabash River at Mount Carmel, Ill. on the Indiana-Illinois boundary, and East Fork White River at Shoals in southeastern Indiana, continued to decrease seasonally but remained above the normal range for the 4th consecutive month. Flow at Shoals was 193 percent of median. (See graph.) In the upper reaches of Wabash River basin in the northeastern part of the State, mean discharge of Mississinewa River at Marion also decreased seasonally and was above the normal range for the 3d time in the past 4 months.



Monthly mean discharge of East Fork White River at Shoals, Ind. (Drainage area, 4,927 sq mi; 12,761 sq km)

In the Sandusky River and Blanchard River basins in northwestern Ohio, runoff from intense rainfall August 30, 31 (6.49 inches reported at Bucyrus) caused flooding along both streams. Also in this part of the State, monthly mean flow of Maumee River at Waterville decreased seasonally but was 224 percent of median and remained above the normal range for the 3d consecutive month. Elsewhere in the State, mean discharges generally decreased and were in the normal range.

In southern Michigan, monthly mean flow of Red Cedar River at East Lansing continued to decrease seasonally, was 62 percent of median, and was near the lower limit of the normal range. In the northern part of the Lower Peninsula, monthly mean discharge of Muskegon River at Evart also continued to decrease seasonally and was in the normal range. Also in this part of the Lower Peninsula, monthly mean levels of Houghton Lake near Houghton Lake Heights and Lake Mitchell-Cadillac were 0.25 foot and 0.12 foot above their respective medians for August. In the Upper Peninsula, mean flow of Sturgeon River near Sidnaw increased, contrary to the normal seasonal pattern, was 211 percent of median, and was near the upper limit of the normal range for the month. Also in the Upper Peninsula, the average monthly level of Lake Michigamme remained 0.5 foot below the 25-year median level for August.

(Continued on page 8.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations in feet above National Geodetic Vertical Datum of 1929 (NGVD), formerly called sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	August 31, 1981	Monthly mean, August		August		
		1981	1980	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.72	600.83	600.87	601.00	602.02 (1950)	599.15 (1926)
Michigan and Huron (Harbor Beach, Mich.)	579.36	579.39	579.76	578.64	580.99 (1973)	575.97 (1964)
St. Clair (St. Clair Shores, Mich.)	574.78	574.93	575.35	573.72	576.03 (1973)	571.60 (1934)
Erie (Cleveland, Ohio)	571.88	572.05	572.54	570.73	573.03 (1973)	568.36 (1934)
Ontario (Oswego, N.Y.)	245.24	245.49	245.71	245.13	247.45 (1947)	242.26 (1934)

LAKE WINNIPEG AT GIMLI, MANITOBA

Alltime high: 718.26 (July 1974). Alltime low: 709.62 (February 1941).	Monthly mean, August				
	1981	1980	Average 1913–80	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	713.45	713.77	714.16	717.73 (1979)	710.40 (1941)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	August 31, 1981	August 31, 1980	August		
			Average, 1904–79	Maximum (year)	Minimum (year)
Elevation in feet above NGVD:	4,198.65	4,199.30	4,198.10	4,204.10 (1923)	4,191.65 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1980): 102.1 (1869). Alltime low (1939–1980): 92.17 (1941).	August 28, 1981	August 31, 1980	August		
			Average, 1939–78	Max. daily (year)	Min. daily (year)
Elevation in feet above NGVD:	96.06	94.86	95.04	98.31 (1976)	93.39 (1949)

FLORIDA

Site	August 1981		July 1981	August 1980
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	660	81	640	820
Miami Canal at Miami (southeastern Florida)	222	78	2.6	104
Tamiami Canal outlets, 40-mile bend to Monroe	1,020	266	62	121

(Continued from page 6.)

In southeastern Ontario, monthly mean flow of Saugeen River near Port Elgin continued to decrease seasonally, was near the median for August, and remained in the normal range for the 9th time in the past 11 months. In the eastern part of the Province, north of Lake Huron, monthly mean discharge of Missinaibi River at Mattice decreased sharply, was only 27 percent of median, and was below the normal range. In western Ontario, mean flow of English River at Umfreville continued to decrease seasonally, was only 40 percent of median, and remained in the below-normal range for the 4th consecutive month and for the 7th time in the past 8 months.

In northeastern Minnesota, monthly mean flow of Basswood River near Winton was 108 percent of the August median discharge and remained within the normal range. In the northwestern part of the State, mean discharge of Roseau River below State Ditch No. 51 near Caribou was 126 percent of median and was in the normal range for the 3d consecutive month, and mean flow of Wild Rice River at Hendrum also remained within the normal range. Also in this part of the State, monthly mean discharge of Buffalo River near Dilworth increased, contrary to the normal seasonal pattern, and was in the normal range, following 2 months of flow in the below-normal range. In north-central Minnesota, monthly mean flow of Little Fork River at Littlefork was in the normal range, and in the west-central part of the State, mean flows of Minnesota River at Montevideo, Pomme de Terre River at Appleton, and Chippewa River near Milan also were in that range. In the southwestern part of the State, where mean discharge of Des Moines River at Jackson was only 13 percent of median and was below the normal range in July, mean flow during August was 36 percent of median and was within the normal range. In central Minnesota, monthly mean flow of Crow River at Rockford decreased seasonally but was 344 percent of median and was above the normal range for the first time since February 1980. In the adjacent basin of Minnesota River, monthly mean discharge near Jordan also decreased seasonally, was 247 percent of median, and was in the above-normal range for the first time since June 1980. Flows in the Mississippi River near Anoka and at St. Paul remained in the normal range for the 3d consecutive month.

In eastern Wisconsin, where mean discharge of Fox River at Rapide Croche Dam near Wrightstown was below the normal range in June and July, monthly mean discharge continued to decrease seasonally but was within the normal range. In the northwestern part of the State, monthly mean flows of Jump River at Sheldon and Chippewa River at Chippewa Falls continued to decrease seasonally, were greater than median, and remained in the normal range. In the south-central part of the State, mean flow of Wisconsin River at Muscoda also decreased seasonally but was above the normal range.

In the adjacent basin of Rock River, in northern Illinois and southern Wisconsin, monthly mean flow of Pecatonica River (tributary to Rock River) at Freeport, Ill. decreased seasonally and remained in the normal range. Downstream, mean discharge of Rock River near Joslin increased, contrary to the normal seasonal pattern, was 172 percent of median, and was in the above-normal range for the 3d time in the past 4 months. In east-central Illinois, the monthly mean discharge of 1,398 cfs in Sangamon River at Monticello (drainage area, 550 square miles) was 2,813 percent of median and was only 3 percent less than the maximum observed monthly mean discharge for August in 71 years of record, and was above the normal range for the 4th consecutive month. In southern Illinois, mean flow of Skillet Fork at Wayne City decreased seasonally, was only 33 percent of median, but remained in the normal range for the 4th consecutive month. Cumulative runoff at this station for the first 11 months of the 1981 water year was only 20 percent of median.

GROUND-WATER CONDITIONS

In Minnesota, levels in shallow water-table wells rose statewide. Levels were nearly 3 feet above average in southern Minnesota; they were above average for the first time in 15 months. In northern Minnesota, however, levels continued below average by 2 feet.

In Michigan, levels declined statewide, and were well below average in parts of the eastern Upper Peninsula and in central and southeastern parts of the Lower Peninsula. Elsewhere in the State, levels were near average.

In Illinois, the level in the key well in glacial drift near Princeton, Bureau County, rose nearly a foot and continued more than 6 feet above average.

Levels in Indiana held steady and were well above average statewide.

Levels in Ohio declined; they were about average in the central part of the State, but continued above average in the northeastern part.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow generally decreased seasonally in Saskatchewan, Louisiana, Missouri, and Texas, but was variable elsewhere in the region. Monthly mean flows remained in the below-normal range in parts of Iowa and

Kansas, and decreased into that range in parts of Louisiana. Monthly mean discharge was lowest of record for the month in parts of Kansas. Flows remained in the above-normal range in parts of Saskatchewan, Arkansas, Iowa, and Texas, and increased into that range in parts of North Dakota and South Dakota. Monthly mean discharge was highest of record for August in parts of North Dakota. Flooding occurred in Nebraska. Water rationing was discontinued in several cities in Oklahoma.

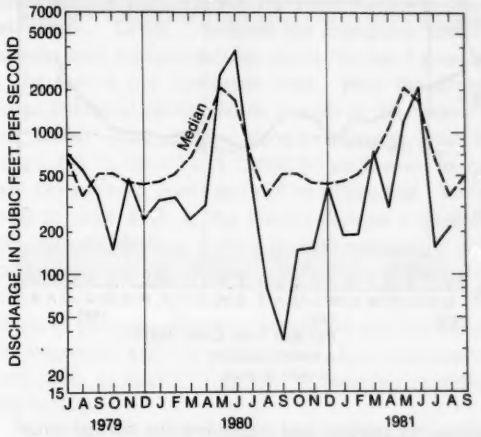
Ground-water levels rose and were above average in Nebraska, and declined and were below average in Arkansas. Trends were mixed in North Dakota and in Iowa, but levels were below and above average, respectively, in these States. Trends were mixed and were above and below average in other States in the region. New August low levels occurred in North Dakota, Arkansas, and Texas, and new alltime lows were reached in two key wells in Kansas.

STREAMFLOW CONDITIONS

In north-central Nebraska, where 8 inches of rain was unofficially reported near Burwell during the first week of August, flooding occurred along North Loup River, Loup River, and lower reaches of Platte River. A peak discharge of 10,000 cfs was observed on North Loup River at Ord (drainage area, 3,750 square miles) which is approximately equal to that of a 50-year flood at that station. Downstream on North Loup River, Loup River, and Platte River, peak discharges approximately equal to those of 5- to 15-year flood events were observed. Some residents of the city of North Loup were reported to have been evacuated from their homes because of flooding along Mira Creek. In southwestern Nebraska, runoff from a major storm August 6 in Medicine Creek (tributary to Republican River) basin upstream from Harry Strunk Lake increased storage in that reservoir to a level that encroached 1.75 feet into the flood pool by August 8. Unregulated flows of streams in the Republican River basin ranged from 140 percent to 400 percent of median for the month. In the northwestern part of the State, mean discharge of Niobrara River above Box Butte Reservoir increased seasonally and remained in the normal range for the 4th consecutive month. In northeastern Nebraska, monthly mean flow of Elkhorn River at Waterloo decreased seasonally and was less than median for the 15th consecutive month, but was in the normal range. Mean flow at this station was in the below-normal range in 12 of the past 14 months, and cumulative runoff for the first 11 months of the 1981 water year was only 39 percent of median.

In northeastern Kansas, where monthly mean discharge of Little Blue River near Barnes was below the normal range for the first 7 months of the 1981 water year, mean flow increased in August, contrary to the normal seasonal pattern, was 130 percent of median, and remained within the normal range. By contrast, in the northwestern part of the State, the monthly mean flow of 3.3 cfs in Saline River near Russell (drainage area, 1,502 square miles) was in the below-normal range for the 11th consecutive month, was only 8 percent of median, and was lowest for August in 30 years of record. In southwestern Kansas, mean flow of Arkansas River at Arkansas City continued to decrease seasonally and remained below median for the 15th consecutive month.

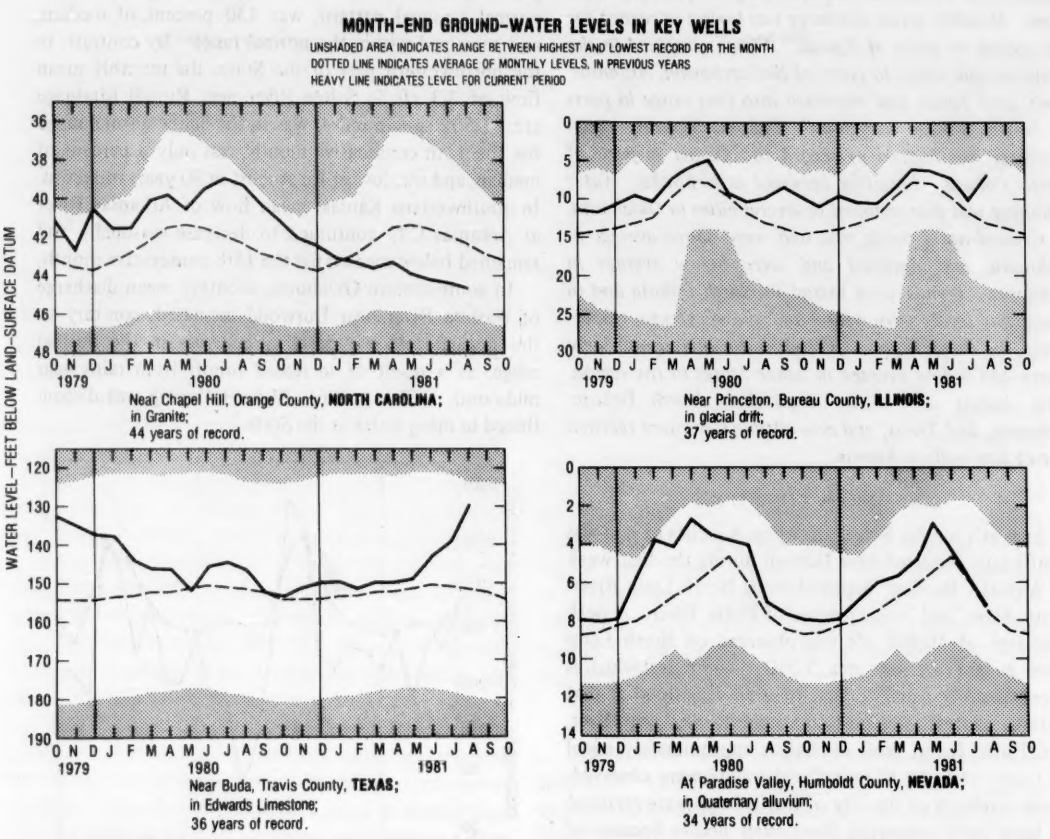
In southwestern Oklahoma, monthly mean discharge of Washita River near Durwood increased, contrary to the normal seasonal pattern, and was in the normal range, as a result of increased runoff from rains near midmonth. (See graph.) Water rationing was discontinued in many cities in the State.



Monthly mean discharge of Washita River near Durwood, Okla. (Drainage area, 7,202 sq mi; 18,653 sq km)

In south-central Texas, monthly mean discharge of Guadalupe River near Spring Branch decreased seasonally but remained in the above-normal range as a result of high carryover flow from July augmented by runoff from above-normal rainfall during the last 3 days of August. In the eastern part of the State, mean flow of Neches River near Rockland decreased sharply from the above-normal flow of July and was below median but was within the normal range. Cumulative runoff at this station for the first 11 months of the 1981 water year was only 33 percent of median. Runoff for August was reported to have been below the normal range in the upper Brazos River and the middle Red River basins. Monthend records for 38 reservoirs in the State showed that storage increased in 4 and decreased in 34.

In northwestern Louisiana, monthly mean flow of Saline Bayou near Lucky decreased sharply, was only



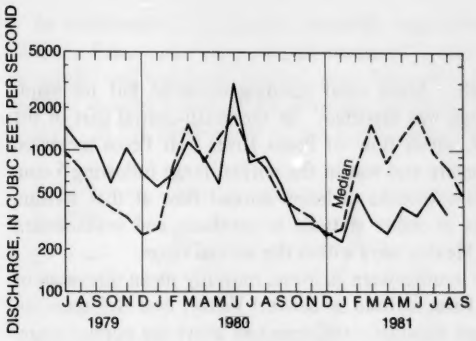
43 percent of median, and was below the normal range for the 6th time in the past 9 months. In the Pearl River basin in southeastern Louisiana and the adjacent area of Mississippi, monthly mean flow of Pearl River near Bogalusa, La. decreased sharply, was only 66 percent of the August median flow, and was below the normal range. Elsewhere in the State, monthly mean flows generally decreased seasonally and were in the normal range.

In southern Arkansas, mean discharge of Saline River near Rye decreased sharply from the above-normal flow of July and was in the normal range. By contrast, in the northern part of the State, monthly mean flow of Buffalo River near St. Joe increased sharply as a result of runoff from several storms during the month, was 977 percent of the August median discharge, and was in the above-normal range.

In Missouri, streamflow generally decreased seasonally but monthly mean discharges remained well above median as a result of high carryover flows from July. For example, in the northwestern part of the State, monthly mean flow of Grand River near Gallatin decreased sharply from the above-normal flow of July but was 292 percent of the median discharge for August and was in the normal range.

In north-central Iowa, where flooding occurred along Des Moines River in June and monthly mean flow at Fort Dodge was above the normal range in July, mean discharge at that index station remained in the above-normal range as a result of high carryover flow augmented by increased runoff from rains early in August. Similarly, in eastern Iowa, monthly mean flow of Cedar River at Cedar Rapids also remained in the above-normal range as a result of high carryover flow from July augmented by runoff from rains early in August. By contrast, in the southwestern part of the State, mean flow of Nishnabotna River above Hamburg decreased seasonally and remained below the normal range for the 6th consecutive month. (See graph on page 11.) Cumulative runoff at this station for the first 11 months of the 1981 water year was only 32 percent of median.

In central South Dakota, monthly mean flow of Bad River near Fort Pierre increased sharply as a result of



Monthly mean discharge of Nishnabotna River above Hamburg, Iowa. (Drainage area, 2,806 sq mi; 7,268 sq km)

runoff from rains early in the month, was 8½ times the August median discharge, and was above the normal range. In the eastern part of the State, mean discharge of Big Sioux River, as measured at Akron, Iowa, decreased seasonally but remained in the normal range. Cumulative runoff at this station for the first 11 months of the 1981 water year was only 27 percent of median.

In southwestern North Dakota, monthly mean flow of Cannonball River at Breien (drainage area, 4,100 square miles) increased sharply as a result of runoff from intense rains near midmonth, and the mean discharge of 405 cfs was highest for August since records began in 1934. In the eastern part of the State, mean flow of Red River of the North at Grand Forks decreased seasonally but was greater than median and remained in the normal range.

In southern Saskatchewan, monthly mean flow of Qu'Appelle River near Lumsden decreased seasonally but was 269 percent of the August median discharge and remained in the above-normal range.

GROUND-WATER CONDITIONS

In North Dakota, the water level in the key well in the western part of the State rose slightly, but even so the level was at a new August low in 13 years of record. In eastern North Dakota, the level in the key well rose 1½ feet and was slightly below average.

In Nebraska, levels were slightly higher in most shallow water-table wells and were generally above average. Levels rose also in irrigated areas of the State as rainfall brought an early conclusion to the irrigation season.

In Iowa, levels in shallow water-table wells rose or fell in response to local precipitation, but all reporting stations were above average for the month. A new high level in 30 years of record was reported in a well in Johnson County in east-central Iowa.

In Kansas, the water level rose slightly and was above average in the Douglas County well; levels declined and were below average in the other three observation wells. New alltime lows were reached in the Halstead well in Harvey County and in the Kansas Agricultural Experiment Station well at Colby in Thomas County, in 41 and 34 years of record, respectively.

In Arkansas, the water level in the deep Sparta Sand aquifer declined 6 feet, and was 52 feet below average for August. In the industrial Sparta Sand aquifer of central and southern Arkansas, the level in the key well at Pine Bluff declined 5 feet and was 37 feet below average, reaching a new August low level in 23 years of record. The level in the El Dorado well declined 4½ feet and was nearly 12 feet below average.

In Louisiana, water-level trends were mixed in the southwestern part of the State. Levels rose in most of the rice-growing area, but declined near the towns of Roanoke, Opelousas, and Kaplan. In the Lake Charles industrial area, water levels were generally lower than last month. Levels in wells in the Evangeline aquifer have declined continuously for about the last 5 months in the Eunice and Opelousas areas. Near the Baton Rouge industrial district, levels in wells in the "400-ft" and "600-ft" sands declined sharply. However, levels in wells in the "1,500-ft" and "2,000-ft" sands rose. In the New Orleans area, levels declined in all aquifers. Water levels in most wells in the Florida Parishes continued their seasonal decline. Levels in wells screened in the Sparta Sand and in Miocene aquifers in northern and central Louisiana continued to decline, reflecting the effects of pumping. Pumping from other aquifers was of less magnitude and less concentrated; thus, measurable water-level declines in response to pumping occurred only locally.

In Texas, water levels in key observation wells rose and were above average in the Edwards aquifer at Austin, and declined but were above average at San Antonio. Levels declined and were below average in the Evangeline aquifer at Houston. At El Paso, the level in the key well in bolson deposits rose but nevertheless was at a new August low in 16 years of record.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow generally decreased seasonally except in Arizona and New Mexico, where flows were variable. Monthly mean flows remained above the normal range in parts of Alberta, Arizona, and New Mexico. Below-normal streamflow persisted in parts of California, Colorado, Idaho, Montana, Nevada, Utah, and Washington, and flows decreased into that range in parts of

Oregon and Wyoming. Flooding occurred in Colorado, Nevada, and New Mexico.

Ground-water levels declined in Washington, Idaho, and Utah; trends were mixed elsewhere in the region. Levels were below average in Washington and in Arizona, and mixed with respect to average in other States. A new high level for August was reached in Nevada, and new lows for August occurred in Idaho and New Mexico. New alltime low levels were noted in Idaho, Utah, and Arizona.

STREAMFLOW CONDITIONS

In the extreme southern part of Nevada, severe flooding occurred along streams in Moapa Valley August 10 as a result of rapid runoff from intense thunderstorms. A peak discharge of about 60,000 cfs was observed on California Wash, tributary to Muddy River, resulting in a peak discharge of about 28,000 cfs in Muddy River at Glendale (drainage area, 780 square miles). Extensive damage in the city of Overton resulted from flooding along Overton Wash. In the northern part of the State, monthly mean flow of Humboldt River at Palisade continued to decrease seasonally, was only 26 percent of median, and remained below the normal range for the 6th consecutive month. Cumulative runoff at this station for the first 11 months of the 1981 water year was only 32 percent of median.

In east-central Colorado, minor flooding occurred near the city of Colorado Springs as a result of rapid runoff from intense thunderstorms during the week of August 3–7. Interstate Highway I-25 was closed for several hours during one of those storms on August 6. In the southwestern part of the State, monthly mean flow of Animas River at Durango decreased seasonally and was in the below-normal range for the 6th time in the past 8 months. West of the Continental Divide in central Colorado, monthly mean discharge of Roaring Fork River at Glenwood Springs continued to decrease seasonally and was below the normal range for the 4th consecutive month and the 7th time in the past 8 months. In the northwestern part of the State, mean flow of Yampa River at Steamboat Springs decreased seasonally and was in the below-normal range for the 8th time in the past 10 months. East of the Continental Divide in north-central Colorado, monthly mean flow of Bear Creek at Morrison also decreased seasonally but was in the normal range. Cumulative runoff at this station during the first 11 months of the 1981 water year was only 49 percent of median.

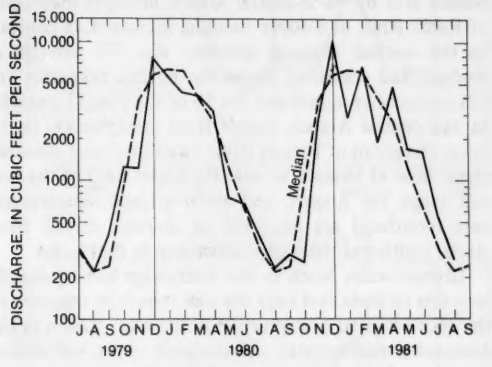
In southwestern New Mexico, monthly mean discharge of Gila River near Gila increased seasonally and remained in the above-normal range for the 2d consecutive month as a result of runoff from rains early in the month. Some local flooding occurred but no major damage was reported. In the north-central part of the State, mean flow of Pecos River near Pecos increased seasonally and was in the normal range following 5 consecutive months of below-normal flow at that station. Flows at index stations in northern and southeastern New Mexico were within the normal range.

In southeastern Arizona, monthly mean discharge of Gila River at head of Safford Valley, near Solomon, increased seasonally and remained above the normal range. In the north-central part of the State, mean flow of Little Colorado River near Cameron decreased sharply, contrary to the normal seasonal pattern, and was below the normal range for the 8th time in the past 11 months. In northwestern Arizona and the adjacent areas of Nevada and Utah, monthly mean discharge of Virgin River, as measured at Littlefield, Arizona, continued to increase seasonally and was in the normal range. In extreme southern Arizona, where mean flow of San Pedro River at Charleston was in the below-normal range from July 1980 through June 1981, monthly mean discharge decreased slightly but remained in the normal range.

In California, in the southern part of the Sierra Nevada west slope, monthly mean discharge in Kings River above North Fork, near Trimmer, continued to decrease seasonally, was 67 percent of the August median discharge, and was below the normal range for the 3d time in the past 4 months. On the central Sierra Nevada east slope, in northern California, mean flow of West Walker River below Little Walker River, near Coleville, continued to decrease, was only 48 percent of median, and remained in the below-normal range for the 3d consecutive month. Also in northern California, on the Sierra Nevada west slope, mean flow of North Fork American River at North Fork Dam continued to decrease seasonally, was 47 percent of the August median discharge, and remained below the normal range for the 5th consecutive month. Cumulative runoff at this station for the first 11 months of the 1981 water year was only 39 percent of median. Regulated flow of Sacramento River at Verona, in north-central California, was the same as during July and was above the normal range. Combined storage in 10 index reservoirs in central and northern California at monthend was 92 percent of average and 78 percent of one year ago.

In western Oregon, monthly mean flow of Umpqua River near Elkton continued to decrease seasonally and was below the normal range for the 5th time in the past 8 months, as a result of low carryover flow from July and below-normal runoff during August. In the adjacent basin of Willamette River, the mean flow at Salem also decreased into the below-normal range.

In southwestern Washington, monthly mean flow of Chehalis River near Grand Mound continued to decrease seasonally and was in the normal range, following 4 consecutive months of flow in the above-normal range. (See graph.) In the eastern part of the State, mean flow of



Monthly mean discharge of Chehalis River near Grand Mound, Wash. (Drainage area 895 sq mi; 2,318 sq km)

Spokane River at Spokane decreased seasonally and was slightly above median but was within the normal range. In the northwestern part of the State, mean discharge of Skykomish River near Gold Bar decreased sharply and remained below the normal range as a result of low carryover flow from July and below-normal runoff during August.

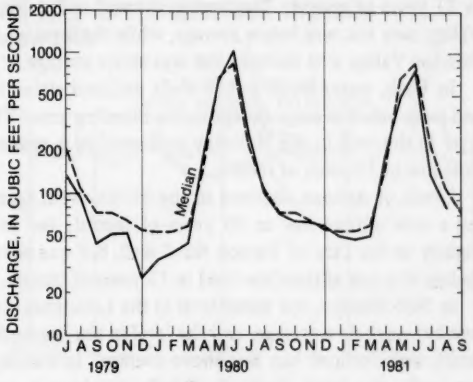
In southwestern Alberta, mean discharge of Bow River at Banff decreased seasonally but remained in the above-normal range as a result of high carryover flow from July and above-normal runoff during August. In British Columbia, monthly mean flows at both index stations decreased seasonally, were near or slightly greater than their respective medians, and remained within the normal range.

In southern Idaho, monthly mean flows in Snake River near Heise (adjusted for storage) and Snake River at Weiser remained below the normal range for the 2d consecutive month. Also in this part of the State, mean flow of Boise River was reported to have been below the normal range. In the central part of the State, mean discharge of Salmon River at White Bird decreased seasonally and was in the below-normal range as a result of low carryover flow from July and below-normal runoff during August. In northern Idaho, monthly mean discharges of Kootenai and Coeur d'Alene Rivers remained in the above-normal range, and that of Clearwater River at Spalding remained within the normal range. Reservoir storage in the State was reported to be near average at monthend.

In Montana, streamflow decreased seasonally in all parts of the State and mean flows were below the normal range in Yellowstone River at Corwin Springs and also at Billings, in the southern part of the State. Elsewhere in Montana, monthly mean discharges were near median and within the normal range.

In northern Wyoming, monthly mean flow of Tongue River near Dayton decreased seasonally but remained in the normal range for the 3d consecutive month. In the southern part of the State, mean discharge of North Platte River above Seminoe Reservoir, near Sinclair, decreased sharply and was below the normal range for the 5th time in the past 6 months. Cumulative runoff at this station for the first 11 months of the 1981 water year was only 53 percent of median.

In Utah, monthly mean flows at 5 of the 7 index stations remained in the below-normal range. In the San Juan River basin in southeastern Utah and the adjacent areas of Colorado, New Mexico, and Arizona, mean discharge as measured near Bluff, Utah, was only 15 percent of median and was below the normal range for the 7th time in the past 11 months. Similarly, mean flow of Colorado River near Cisco was 42 percent of median and was below the normal range for the 7th consecutive month. In northeastern Utah, monthly mean flow of Weber River near Oakley was 73 percent of median and was below the normal range for the 5th time in the past 7 months. (See graph.) Also in this part of the State,



Monthly mean discharge of Weber River near Oakley, Utah. (Drainage area, 162 sq mi; 420 sq km)

mean discharge of Big Cottonwood Creek near Salt Lake City was 67 percent of median and remained below the normal range for the 4th consecutive month. Mean flow in Beaver River near Beaver, in southwestern Utah, and Whiterocks River near Whiterocks, in the northeastern part of the State, were 94 percent of their respective median discharges and were in the normal range.

Contents of the Colorado River Storage Project decreased 803,000 acre-feet during the month.

GROUND-WATER CONDITIONS

In Washington, the level in the key well in Tacoma declined and was nearly 9 feet below average. The level in the Spokane Valley well in eastern Washington also declined and was 4½ feet below average.

In Idaho, the level in the well penetrating the sand and gravel aquifer in Boise Valley declined slightly but was above average. Levels in the key wells in the Snake River Plain aquifer continued to decline and reached new alltime lows in the eastern and south-central parts of the plain, in 32 and 31 years of record, respectively. Levels were at new August lows in the southwestern part in 24 years of record, and were below average in the western part. Water levels in the alluvial aquifer underlying the Rathdrum Prairie in northern Idaho were below average.

The water level in the key well at Hamilton Fairgrounds in Montana rose slightly but continued below average by less than a foot.

In southern California, water levels in the five index wells declined in three wells but rose slightly in the Orange County well and in the well at Lompoc, in Santa Barbara County.

In Nevada, the level in the key well in Steptoe Valley declined but nevertheless was at a new high for August in 31 years of record. The level in the well in Las Vegas Valley rose but was below average, while the level in the Paradise Valley well declined but was above average.

In Utah, water levels in key wells declined statewide and were below average except in the Blanding area. The level in the well in the Holladay area reached a new alltime low in 33 years of record.

Levels in Arizona declined in the Elfrida well, reaching a new alltime low in 30 years of record, and rose slightly in the City of Tucson No. 2 well, but was nevertheless at a new alltime low level in 13 years of record.

In New Mexico, the water level in the Lovington well rose but was below average, and the level in the Berrendo-Smith well declined but was above average. In the Dayton well, the level declined slightly, reaching a new August low in 43 years of record.

ALASKA

Streamflow increased, contrary to the normal seasonal pattern, at all index stations except Chena River at Fairbanks where mean flow decreased from the above-normal discharge of July. Rapid runoff from intense rainfall in the vicinity of Prince William Sound caused flooding in the Cordova-Valdez area. A new maximum discharge for the period of record (which began in 1947) was observed in Power Creek near Cordova. Precipitation recorded at Anchorage during August was reported to have been near the maximum for the month. Monthly mean discharge of Little Susitna River near Palmer (near Anchorage) continued to increase, contrary to the normal seasonal pattern, was 177 percent of median, and remained above the normal range. Similarly, in the coastal area of south-central Alaska, monthly mean flow of Kenai River at Cooper Landing increased, in contrast to the normal seasonal pattern, was 170 percent of median, and remained above the normal range for the 8th consecutive month and for 10 of the past 11 months. In east-central Alaska, runoff from precipitation in the lower elevations of Tanana River basin increased monthly mean flow at Nenana to near the upper limit of the normal range for August, and above-normal temperatures near monthend are expected to increase runoff from glacial melting at the higher elevations in that basin.

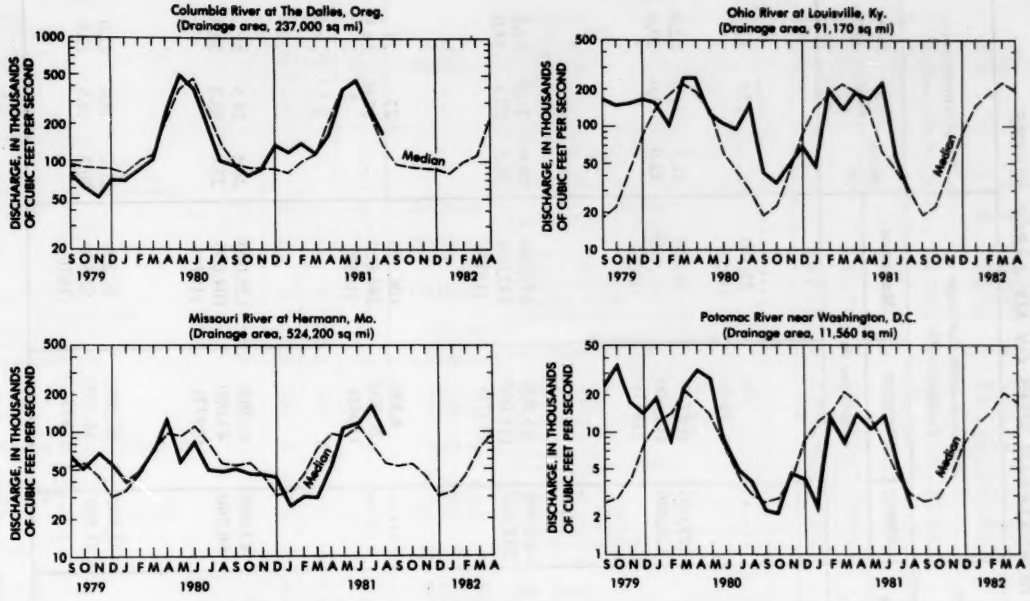
Ground-water levels in the Anchorage bowl generally rose one to three feet over the past month in response to the above-normal precipitation in the area. Levels in the downtown metropolitan area declined several feet due to pumpage of the aquifer for water supply purposes.

HAWAII

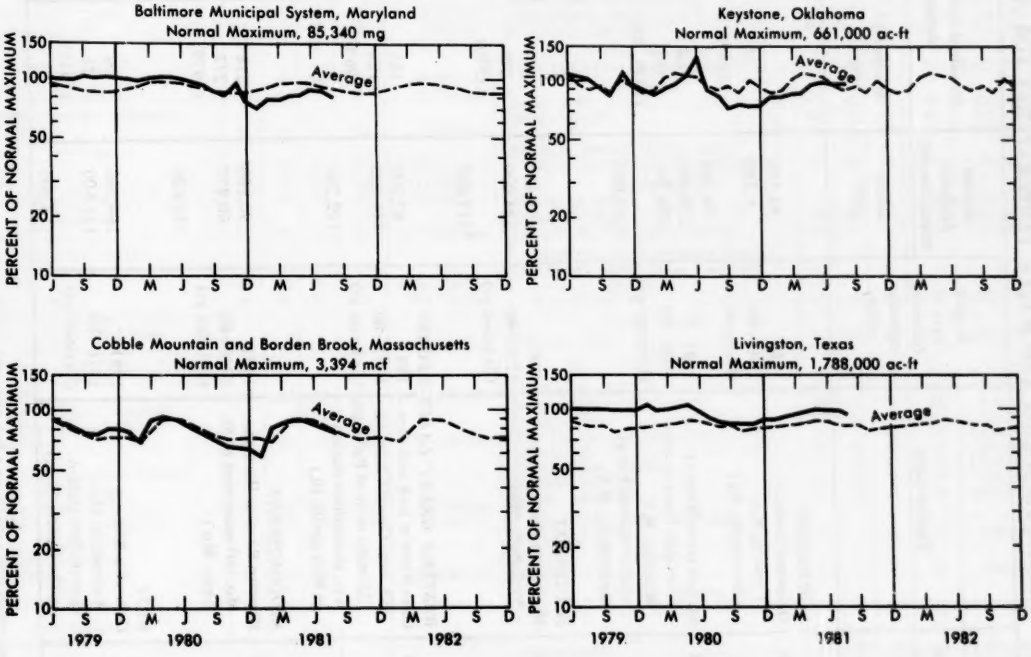
Monthly mean streamflows increased throughout the State but daily mean flows were lowest of record for August in some areas. For example, on the island of Maui, the daily mean discharge of 0.24 cfs on August 1, 2 in Honopou Stream near Huelo (drainage area, 0.64 square miles) was lowest for the month since records began in 1910. The monthly mean flow of 1.13 cfs at that station was only 40 percent of the August median, and was in the below-normal range for the 3d consecutive month and for the 8th time in the past 9 months. Voluntary water-use restrictions which were started in July were continued through August on Maui. On the island of Hawaii, the daily mean discharge of 0.08 cfs on August 1, 2 in Waiakea Stream near Mountain View (drainage area, 17.4 square miles) was lowest for the month since records began in 1930. Runoff from rains on August 4 increased monthly mean flow at this station from 1 percent of median in July (below-normal range) to 117 percent of median in August (normal range), following 8 consecutive months of below-normal flow at that station, and ended the drought period that began in November 1980. Restrictions in domestic and irrigation water use were reported to have been rescinded in all drought affected areas on the island. On the island of Kauai, monthly mean flow of East Branch of North Fork Wailua River near Lihue continued to increase seasonally and remained in the above-normal range. On the island of Oahu, mean flow of Kalihi Stream near Honolulu also increased, was slightly greater than median, and remained in the normal range.

On Guam, Mariana Islands, monthly mean flow of Ylig River near Yona was 272 percent of the August median discharge and was above the normal range. No data are available for July for this station.

HYDROGRAPHS OF FOUR LARGE RIVERS



USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS
June 1979 to August 1981



DISSOLVED SOLIDS AND WATER TEMPERATURES FOR AUGUST AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	August data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at Trenton, N.J.	1981	*3,570	.....	.....	.....	.....	.....	.....	.....	.....
	(Morrisville, Pa.)	1945–80 (Extreme yr)	6,250	67 (1945)	158 (1967)	.....	505 (1965)	21,500 (1955)	.....	17.5	31.5
			[c]4,268								
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y.	1981	279,000	164	167	125,000	118,000	128,000	21.5	21.0	22.0
		1976–80 (Extreme yr)	286,700	165 (1979, 80)	170 (1978)	128,000	113,000 (1977)	153,000 (1976)	22.0	19.0	24.0
	median streamflow at Ogdensburg, N.Y.		[c]252,000								
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss.	1981	498,400	262	196	305,000	261,000	370,000	28.0	26.0	29.5
		1976–80 (Extreme yr)	384,000	200 (1980)	290 (1978)	248,000	118,000 (1977)	442,000 (1979)	30.0	27.5	34.0
			[c]317,600								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill.	1981	87,200	155	241	.....	4,490	106,000	.....	27	29
		1955–80 (Extreme yr)	141,300	128 (1963)	339 (1977)	.....	20,300 (1965)	246,000 (1958)	.....	17.0	30.5
	(25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)		[c]102,200								
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1981	90,100	218	445	83,000	63,900	125,000	26.5	24.5	29
		1976–80 (Extreme yr)	60,970	272 (1979)	535 (1979)	66,700	43,000 (1977)	104,000 (1979)	27.0	25.0	30.0
			[c]55,620								
	WEST										
14128910	Columbia River at Warrendale, Oreg.	1981	164,000	79	84	35,800	26,200	50,200	21.0	20.0	22.0
		1976–80 (Extreme yr)	131,600	71 (1976)	100 (1977)	31,500	14,200 (1978)	52,500 (1976)	20.5	18.5	22.0
	(streamflow station at The Dalles, Oreg.)		[c]153,200								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved-solids and water-temperature records not available.

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF AUGUST 1981

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of July 1981	End of Aug. 1981	End of Aug. 1980	Average for end of Aug.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	61	49	53	49	226,300 (a)
QUEBEC					
Allard (P)	81	92	85	67	280,600 ac-ft
Gouin (P)	91	82	75	65	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	77	80	58	67	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	93	84	84	84	3,330 mcf
Lake Francis (FPR)	83	90	82	82	4,326 mcf
Lake Winnipesaukee (PR)	95	88	80	75	7,220 mcf
VERMONT					
Harriman (P)	71	69	74	70	5,060 mcf
Somerset (P)	74	63	75	76	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	79	75	74	78	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	82	73	71	70	34,270 mcf
Indian Lake (FMP)	94	95	94	73	4,500 mcf
New York City reservoir system (MW)	77	67	70	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	78	66	61	74	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	50	41	51	42	51,400 mcf
Pymatuning (FMR)	95	88	99	87	8,191 mcf
Raystown Lake (FR)	67	61	66	60	33,190 mcf
Lake Wallenpaupack (PR)	75	64	62	64	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	86	80	93	89	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	88	87	88	88	12,580 mcf
Narrows (Badin Lake) (P)	95	122	82	98	5,616 mcf
High Rock Lake (P)	83	51	71	74	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	91	89	84	72	70,300 mcf
Lakes Marion and Moultrie (P)	83	84	67	68	81,100 mcf
SOUTH CAROLINA–GEORGIA					
Clark Hill (FP)	50	48	72	67	75,360 mcf
GEORGIA					
Burton (PR)	99	89	85	87	104,000 ac-ft
Sinclair (MPR)	82	79	90	86	214,000 ac-ft
Lake Sidney Lanier (FMPR)	52	46	55	58	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	93	89	88	86	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	49	43	41	47	1,156,000 cfsd
Douglas Lake (FPR)	60	39	38	47	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	65	57	66	69	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	60	52	37	54	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	67	60	63	68	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	90	81	74	76	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	86	68	64	64	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	35	34	23	35	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	78	76	82	95	22,700,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	64	57	71	77	127,600 ac-ft
Bell Fourche (I)	44	...	8	39	185,200 ac-ft
Lake Francis Case (FIP)	76	77	78	77	4,834,000 ac-ft
Lake Oahe (FIP)	69	68	75	.....	22,530,000 ac-ft

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of July 1981	End of Aug. 1981	End of Aug. 1980	Average for end of Aug.	Normal maximum
	Percent of normal maximum				
MIDCONTINENT REGION–Continued					
SOUTH DAKOTA–Continued					
Lake Sharpe (FIP)	97	101	103	99	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	92	92	95	96	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	75	75	72	67	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	90	84	80	81	2,378,000 ac-ft
Keystone (FPR)	95	96	84	89	661,000 ac-ft
Tenkiller Ferry (FPR)	99	101	89	91	628,200 ac-ft
Lake Altus (FIMR)	26	8	36	49	133,000 ac-ft
Lake O'The Cherokees (FPR)	98	90	79	83	1,492,000 ac-ft
OKLAHOMA–TEXAS					
Lake Texoma (FMPRW)	92	88	85	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	37	30	21	46	386,400 ac-ft
Canyon (FMR)	101	94	88	73	385,600 ac-ft
International Amistad (FIMPW)	100	101	82	81	3,497,000 ac-ft
International Falcon (FIMPW)	101	106	75	66	2,668,000 ac-ft
Livingston (IMW)	100	96	86	82	1,788,000 ac-ft
Possum Kingdom (IMPRW)	93	89	82	99	570,200 ac-ft
Red Bluff (PI)	17	17	11	22	307,000 ac-ft
Toledo Bend (P)	98	88	88	84	4,472,000 ac-ft
Twin Buttes (FIM)	46	40	26	28	177,800 ac-ft
Lake Kemp (IMW)	68	60	44	83	268,000 ac-ft
Lake Meredith (FMW)	17	31	24	39	821,300 ac-ft
Lake Travis (FIMPRW)	98	90	73	75	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	100	98	97	94	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	103	103	102	104	5,022,000 ac-ft
Lake Chelan (PR)	100	99	95	94	676,100 ac-ft
Lake Cushman	102	97	96	96	359,500 ac-ft
Lake Merwin (P)	106	107	102	103	245,600 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	75	55	66	57	1,235,000 ac-ft
Coeur d'Alene Lake (P)	99	98	96	74	238,500 ac-ft
Pend Oreille Lake (FP)	99	99	100	100	1,561,000 ac-ft
IDAHO–WYOMING					
Upper Snake River (8 reservoirs) (MP)	67	47	62	55	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	92	90	90	86	802,000 ac-ft
Buffalo Bill ((IP)	94	74	78	89	421,300 ac-ft
Keyhole (F)	27	26	57	50	190,400 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	54	45	64	49	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	5	9	15	16	364,400 ac-ft
Taylor Park (IR)	68	60	92	78	106,200 ac-ft
Colorado–Big Thompson project (I)	65	55	79	63	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	84	82	93	.....	31,620,000 ac-ft
UTAH–IDAHO					
Bear Lake (IPR)	71	65	88	62	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	67	62	69	67	1,000,000 ac-ft
Hetch Hetchy (MP)	88	75	95	69	360,400 ac-ft
Isabella (FIR)	40	32	76	31	568,100 ac-ft
Pine Flat (FI)	49	31	77	41	1,001,000 ac-ft
Clair Engle Lake (Lewiston) (P)	85	78	86	78	2,438,000 ac-ft
Lake Almanor (P)	78	75	95	56	1,036,000 ac-ft
Lake Berryessa (FIMW)	79	76	85	79	1,600,000 ac-ft
Millerton Lake (FI)	51	36	76	42	503,200 ac-ft
Shasta Lake (FIPR)	71	59	77	71	4,377,000 ac-ft
CALIFORNIA–NEVADA					
Lake Tahoe (IPR)	46	36	92	62	744,600 ac-ft
NEVADA					
Rye Patch (I)	55	44	93	62	194,300 ac-ft
ARIZONA–NEVADA					
Lake Mead and Lake Mohave (FIMP)	84	83	90	72	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	34	29	69	14	1,073,000 ac-ft
Salt and Verde River system (IMPR)	59	55	79	39	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	24	45	42	86	330,100 ac-ft
Elephant Butte and Caballo (FIPR)	36	32	50	24	2,453,000 ac-ft

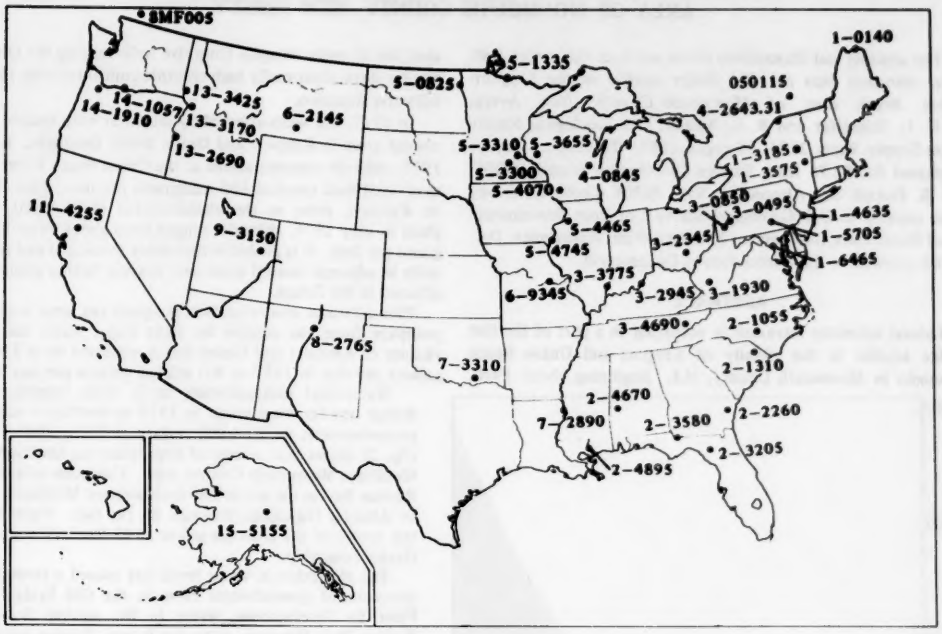
[a]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

FLOW OF LARGE RIVERS DURING AUGUST 1981

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1975 (cfs)	August 1981					
				Monthly mean discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine	5,690	9,549	23,228	669	+285	8,600	5,600	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,853	1,190	109	+45	640	410	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,630	1,443	101	-6	718	464	25
1–4635	Delaware River at Trenton, N.J	6,780	11,630	3,571	84	-31	2,900	1,870	30
1–5705	Susquehanna River at Harrisburg, Pa	24,100	34,200	7,200	95	-49	4,200	2,700	30
1–6465	Potomac River near Washington, D.C	11,560	[1]11,190	2,420	79	-53	1,780	1,150	30
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C	4,810	5,007	2,960	100	+18	2,270	1,470	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,657	6,300	103	+28	4,410	2,850	27
2–2260	Altamaha River at Doctortown, Ga	13,600	13,780	3,175	51	+32	3,310	2,140	30
2–3205	Suwannee River at Branford, Fla	7,880	6,970	2,140	40	-4	2,060	1,330	30
2–3580	Apalachicola River at Chattahoochee, Fla	17,200	22,330	8,210	58	-4	8,210	5,310	31
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala	15,400	22,570	2,284	48	-29	2,100	1,360	27
2–4895	Pearl River near Bogalusa, La	6,630	9,263	1,825	66	-60	1,740	1,120	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1]19,210	7,975	170	-7	4,630	2,990	25
3–0850	Monongahela River at Braddock, Pa	7,337	[1]12,360	5,052	122	-25	3,750	2,420	25
3–1930	Kanawha River at Kanawha Falls, W.Va	8,367	12,530	2,795	67	-40	2,110	1,360	28
3–2345	Scioto River at Higby, Ohio	5,131	4,513	781	86	-63	556	359	31
3–2945	Ohio River at Louisville, Ky[2]	91,170	114,100	29,270	98	-50	21,300	13,800	25
3–3775	Wabash River at Mount Carmel, Ill	28,635	27,030	21,750	255	-27	25,400	16,400	31
3–4690	French Broad River below Douglas Dam, Tenn	4,543	[1]6,794	2,498	80	-6	.....	.....	...
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis[2]	6,150	4,185	1,875	86	-4	2,600	1,680	29
02MC002 (4–2643,31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y[3]	299,000	241,100	279,000	111	+6	286,000	185,000	31
050115	St. Maurice River at Grand Mere, Quebec	16,300	25,300	2,240	14	-87	17,000	11,000	31
5–0825	Red River of the North at Grand Forks, N. Dak	30,100	2,524	1,440	120	-40	1,900	1,230	25
5–1335	Rainy River at Manitou Rapids, Minn	19,400	12,950	7,730	71	-49	6,700	4,330	28
5–3300	Minnesota River near Jordan, Minn	16,200	3,412	4,536	247	-33	7,700	4,980	30
5–3310	Mississippi River at St. Paul, Minn	36,800	[1]10,580	11,400	158	-24	15,000	9,700	31
5–3655	Chippewa River at Chippewa Falls, Wis	5,600	5,110	3,230	113	-21	680	440	30
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,613	6,724	136	-19	9,010	5,820	31
5–4465	Rock River near Joslin, Ill	9,551	5,852	4,790	172	+24	3,800	2,460	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	62,570	69,100	181	-15	69,900	45,200	31
6–2145	Yellowstone River at Billings, Mont	11,796	6,986	3,590	68	-67	2,600	1,680	31
6–9345	Missouri River at Hermann, Mo	524,200	79,750	163,900	206	+40	309,000	200,000	31
7–2890	Mississippi River at Vicksburg, Miss[4]	1,140,500	573,600	498,400	157	-16	376,000	243,000	31
7–3310	Washita River near Durwood, Okla	7,202	1,414	215	59	+38	127	82	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex	9,730	724	287	97	+13	250	160	31
9–3150	Green River at Green River, Utah	40,600	6,366	806	26	-67	2,060	1,330	27
11–4255	Sacramento River at Verona, Calif	21,257	19,150	13,600	158	0	13,500	8,730	27
13–2690	Snake River at Weiser, Idaho	69,200	18,170	8,522	79	+4	9,140	5,910	29
13–3170	Salmon River at White Bird, Idaho	13,550	11,290	4,819	88	-59	6,930	4,480	29
13–3425	Clearwater River at Spalding, Idaho	9,570	15,570	3,694	103	-67	5,830	3,770	29
14–1057	Columbia River at The Dalles, Oreg[5]	237,000	194,600	166,000	117	-44	.....	.....	...
14–1910	Willamette River at Salem, Oreg	7,280	23,810	3,070	76	-52	7,490	4,840	27–31
15–5155	Tanana River at Nenana, Alaska	25,600	23,850	60,935	110	0	50,000	32,000	31
8MF005	Fraser River at Hope, British Columbia	83,800	96,400	122,500	103	-27	92,900	60,000	29

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 18.

WATER RESOURCES REVIEW

August 1981

Based on reports from the Canadian and U.S. Field offices; completed September 16, 1981

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for August based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for August 1981 is compared with flow for August in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for August is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range*. In the Water resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the August flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of August. Water level in each key observation well is compared with average level for the end of August determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels*, unless described otherwise, are from the end of July to the end of August.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

SALTWATER INTRUSION INTO THE OLD BRIDGE AQUIFER IN THE KEYPORT-UNION BEACH AREA OF MONMOUTH COUNTY, NEW JERSEY

The abstract and illustrations below are from the report, *Saltwater intrusion into the Old Bridge aquifer in the Keyport-Union Beach area of Monmouth County, New Jersey,* by F. L. Schaeffer and R. L. Walker, U.S. Geological Survey Water-Supply Paper 2184, 21 pages, 1981. This report may be purchased for $2.75 from Eastern Distribution Branch, USGS, 604 S. Pickett St., Alexandria, VA 22304 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

Lateral saltwater intrusion is occurring in a part of the Old Bridge aquifer in the vicinity of Keyport and Union Beach Boroughs in Monmouth County, N.J. Beginning about 1970, analyses of water samples from five wells tapping the Old Bridge aquifer show abnormally high chloride concentrations, indicating saltwater intrusion.

In 1977, the wells affected by saltwater were limited to near-coastal areas in Keyport and Union Beach Boroughs. By March 1977, chloride concentrations at the Union Beach Water Department well field reached 660 milligrams per liter. (See figure 1.) At Keyport, prior to the abandonment of its Myrtle Avenue plant in May 1976, chlorides ranged from about 40 to 110 milligrams per liter. It is probable that other municipal and industrial wells in adjacent coastal areas and in areas further inland will be affected in the future.

This saltwater contamination is significant since total annual pumpage from the aquifer by eight major water users in the vicinity of Keyport and Union Beach increased from 3.9 million gallons per day in 1957 to 8.0 million gallons per day in 1976.

Water-level measurements in 31 wells tapping the Old Bridge aquifer were made in 1977 to develop a map of the potentiometric (water-level) surface of the aquifer. This map (fig. 2) shows that a cone of depression has developed in the Middlesex Monmouth County area. This cone extends under Raritan Bay in the north and from western Middlesex County to Atlantic Highlands Borough on the east. Water levels at the center of the cone are as low as 45 feet below sea level in Hazlet Township.

The reduction in water levels has caused a reversal in the direction of ground-water flow in the Old Bridge aquifer. Prior to development, water in the aquifer flowed into Raritan Bay. However, saltwater is now flowing inland from the submerged (exposed) outcrop of the aquifer beneath Raritan Bay. The average rate of saltwater flow towards Hazlet Township was determined to be 400 feet per year (1977).

Two other potential sources of saltwater contamination are discussed and evaluated: saltwater infiltration through abandoned, unsealed wells, and contamination from excavations for sewerlines. The study shows, however, that neither source contributed significantly to the saltwater contamination of the Old Bridge aquifer.

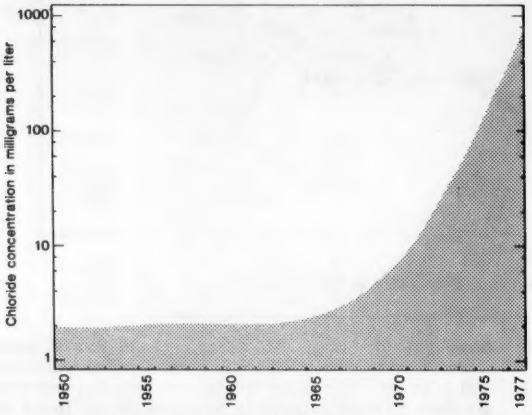

Figure 1.—Chloride concentrations in water samples from the Union Beach Borough well field (1950–77).

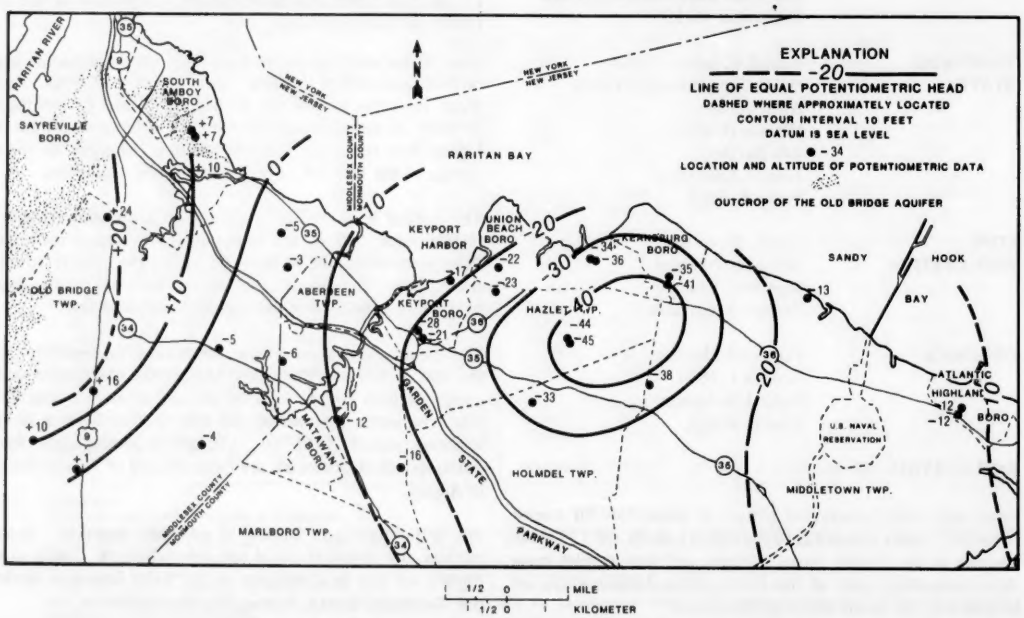

Figure 2.—Potentiometric surface of the Old Bridte aquifer (January 1977).

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